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(54) IMPROVEMENTS IN AND RELATING TO CONTAINERS FOR BULK GRANULAR MATERIALS

(71) We, ZEPHYR PLASTIC PRODUCTS LIMITED, a British Company of Clarence Drive, Filey, North Yorkshire, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The invention relates to containers for bulk granular materials.

The transport of bulk granular materials in containers such as aluminium boxes, which can be detachably secured to a transporting vehicle and unloaded at the point of despatch, is common practice. One example of a bulk granular material transported in this way is refined white sugar. It is also common practice for these aluminium boxes to be lined with a 'bag' of resilient plastics material, made for example from the material known commercially as 'polythene' and having the general form of a long sausage-like tube, closed at both ends but incorporating one or more filling points along its length. The filling of the lined containers presents problems, as the polythene liners may typically be some 30 feet long and eight feet square in cross-section, and require to have four filling points along their length, each capable of coping with a very high-volume intake of material.

One method previously used to fill such lined containers involves the use of a material known as 'lay-flat' tubing. This comprises a cylindrical tube, also of polythene, which is initially flattened and is inserted into a slit formed longitudinally in the wall of the polythene liner. The bulk granular material is then forced through the 'lay-flat' tubing, causing the tubing to assume a cylindrical cross-section within the slit into which it has been inserted, and the liner is rapidly filled.

The drawbacks of this method are caused chiefly by the tendency of the slit in the liner wall to elongate under the pressure exerted by the material passing through the cylindrical tubing, and this tendency becomes worse as the liner approaches a full condition and the slit is subject to additional pressure from the liner contents. The lack of a seal between the cylindrical container and the essentially parallel edges of the slit can cause considerable loss of the bulk granular material as this elongation occurs.

In an attempt to minimise this drawback, the edges of the slit in the liner wall can be welded around the sides of the initially flat tubing after the flattened tubing has been inserted into the slit and before any filling of the liner is attempted. However, when the liner is subsequently filled through the tubing, the latter is again blown out into a cylindrical cross-section and the tendency to force the slit open is repeated. Although this welded construction has proved better than the one previously outlined above, the design is still fundamentally unsatisfactory.

According to the invention there is provided a method of making a filling tube for a container liner for bulk granular materials, the method comprising the steps of taking a sheet of flexible plastics material in which a filling aperture has been formed, stretching the aperture over a tubular mandrel of larger diameter than the aperture so as to form around the periphery of the aperture a lip which projects from the plane of the sheet, fitting over the mandrel and around said lip a flexible plastics tube, and heat welding the tube to the lip around their region of overlap. Said sheet may comprise, or form part of, a wall of the liner; alternatively the method may comprise the further step of heat welding or otherwise sealing the sheet onto a wall of the liner.

The invention includes within its scope a container liner incorporating one or more filling tubes made in accordance with the invention.

According to a further aspect of the invention there is provided a machine for producing a filling tube embodying the invention, the machine comprising a table, a tubular mandrel projecting from the surface of the table, a pair of jaws movable into and out of a position in which they closely surround the peripheral surface of the mandrel, and heating elements incorporated in the jaws, the arrangement being such that the heated jaws can be moved into their mandrel-surrounding position, carry out a heat-welding operation around the region of overlap of a flexible plastics tube and a lipped flexible plastic sheet fitted over the mandrel, and then be withdrawn from their mandrel-surrounding position to enable the welded assembly to be removed from the mandrel.

In this specification, the term "tubular" is intended to include non-circular sections, e.g. squares and triangles, within its scope.

Also the term "liner" is used generically and not restrictively: it includes within its scope containers which need not necessarily be used inside a further structure in order to support their contents during use.

In the accompanying drawings:—

FIGURE 1 shows in perspective two parts of a filling tube assembly for a liner embodying the invention;

FIGURE 2 shows, also in perspective, a machine embodying the invention and intended for producing a filling tube assembly similar to that of Figure 1;

FIGURE 2*a* shows, in plan view and in greater detail to an enlarged scale, one of the jaws used in the machine of Figure 2;

FIGURE 3 shows, in section and side elevation, a central portion of the machine of Figures 2 and 2*a*;

FIGURES 4 and 5 show, in side section and plan respectively, the filling tube assembly secured to the wall of a container liner;

FIGURE 6 shows, in "exploded" perspective, the components of Figures 4 and 5; and

FIGURES 7, 8 and 9 are equivalents of Figures 4, 5 and 6 respectively but showing a further construction of liner.

Referring first to Figure 1, the filling tube assembly shown consists of two parts. Both parts are made of a resilient plastics material, such as the clear flexible thermoplastics material known commercially as 'polythene'. The filling tube itself is a cylindrical tube 11 of this material, and the second part of the assembly is a square sheet 12 of polythene out of the centre of which is cut a circular hole. The internal diameter of the tube 11 is initially slightly greater than the diameter of the hole cut out of the sheet 12.

Referring now to Figures 2 and 3, the machine shown in these figures is intended to heat-seal the two parts of Figure 1 together around their common periphery 13, 14, so that the square sheet 12 can in turn be heat sealed around its outer periphery 15 to the outer surface of the walls of a polythene liner to be filled with bulk granular material. The machine is built up around an angle-iron framework indicated generally at 16, and has two parallel spaced-apart supporting rods 19 running along its length. On these rods 19 slide two jaws 21, and a table 17 with an asbestos top is positioned mid-way between the ends of the machine. A mandrel 18 is positioned in the centre of the table 17, and the function of these various parts will now be explained in detail.

FIGURE 2*a* shows in greater detail the construction of one of the jaws 21. The jaw ends in a semi-circular cut-out portion, and this portion is lined with a ring 22 of fire-clay to act as an insulator for a semi-circular metal band 23 which is connected to the wires of an electrical heating element 24. A glass-fibre tape 25 coated with PTFE runs around the radially innermost periphery of this assembly, and overlays the edges of the jaw assembly, and the properties of this material are such that it can act as a non-stick surface whilst allowing heat from the heated metal band 23 to penetrate through it.

The construction of both jaws is identical, and their positioning is such that they can be slid into a position in which they surround the lower portion of the mandrel 18. The movement of both jaws 21 towards and away from one another is automatically effected by a pneumatic cylinder (not shown).

Referring now to Figure 3, the mandrel 18 is seen to be generally conical in shape and to comprise a lower, relatively short, cylindrical section merging into an upper conical section. The diameter of the lower cylindrical section of the mandrel is slightly greater than that of the hole cut in the plastics sheet 12 of Figure 1. Thus, when the sheet 12 is fitted over the mandrel 18 and forced down over the cylindrical section onto the table 17, material around the edge of the hole 14 is stretched and an upstanding lip is formed around the periphery of the hole 14. A hard rubber ring 26 surrounds the bottom cylindrical portion of the mandrel 18, and a layer of PTFE-coated glass fibre tape 27 runs around this ring 26, again to act as a non-stick surface.

Having placed the sheet 12 of plastics

material over the mandrel 18, and forced it down around the lower cylindrical portion of the mandrel in order to form the upstanding lip around the circular hole 14, the tube 11 of plastics material is then slid down over the mandrel. The diameter of the tube 11 is such that it is a close sliding fit over the upstanding lip formed in the square sheet 12. A further sheet 28 of hard rubber, such as is sold under the registered Trade Mark 'Neoprene' is then slid over both the tube 11 and the sheet 12 and acts as a heat insulator to prevent the sheet 12 from being unduly affected by the heated jaws 21 when they pass over it.

Each jaw is permanently heated to a temperature of approximately 100°C and the two jaws are moved towards one another simultaneously so as to embrace the lower cylindrical portion of the mandrel 18 and thus to heat-weld the two parts 11, 12 of the assembly together. The heated jaws are kept in position, typically for about 1 minute if the plastics material of the two parts is up to ten-thousandths of an inch thick, and are then withdrawn.

During this process, the Neoprene shield 28 prevents the heated jaws from unduly affecting the square 12 of material, but the tube 11 is firmly welded to the lip rising from the square sheet 12.

The sheet 12 is then heat-sealed in turn to the outer surface of the wall of a polythene liner indicated generally at 29 in Figures 4 to 9. In these figures, the weld lines between the filling tube and the square sheet, and the square sheet and the liner wall, are indicated at 31. Finally, a square hole is cut out of the liner wall, as shown at 32 in Figures 4, 5 and 6, so that the liner can be filled through the tube 11.

Figures 7, 8 and 9 show an alternative construction. In this, instead of a hole being cut in the wall of the liner after the sheet 12 has been welded onto its outer surface, crossed slits 33 are formed in the wall within the periphery of the heat weld 31. The slits fail, however, by a small amount to meet at their common centre. Thus, the liner wall remains substantially intact and the centre piece of the slits is eventually broken by the initial intake of material through the filling tube 11. Once this has happened, the areas of material around the slits become merely loose flaps which open under the weight of the material being forced past them.

In a further modification, it is conceivable that when the sheet 12 has been heat welded as at 31 to the outer surface of the liner wall, the construction of the liner ends there. It would be a simple enough job for the eventual user of the liner, having inserted it into the container with which it is to be used, to slit the liner wall within the periphery of the weld 31 in order to admit material to the interior of the liner.

In a further embodiment of the invention (not shown in any of the drawings) the sheet 12 of the filling tube assembly could be dispensed with altogether. In this case, a circular hole equivalent to the hole 14 could be cut in the wall of the liner itself, and this then forced down over the cylindrical section of the mandrel 18 to form the necessary peripheral lip to which the filling tube 11 could then be welded direct. The tube would, of course, still be welded around the outside of the lip, and thus secured around the outer surface of the aperture formed in the liner wall as distinct from being inserted into any such aperture.

The liner 29 itself consists of an initially flattened tube of flexible plastics film, which tube is of a length at least equal to the length of the container to be lined plus the width or height of said container, and is either folded to have a longitudinal gusset in each of two opposite sides with the gussets extending to the longitudinal centre line of the folded tube, or folded so that opposite side portions of the tube are folded over longitudinally to the longitudinal centre line of the tube. The opposite ends of such a tube can be welded transversely to seal them, one or more filling tubes can be secured to the outer surface of the main liner tube in any of the ways outlined above, and lifting eyelets or flaps can then be incorporated into the liner.

In all the embodiments discussed above it will be appreciated that the transition between the filling tube and liner is always circular in cross-section and is positively sealed, and thus the drawbacks of the previous "slit" method cannot arise. In addition, as the filling passage between the tube and liner is never less in diameter than the filling tube, a liner embodying the invention lends itself to the use of a wide variety of actual filling methods. For instance, a rotating disc can be lowered through the filling tube and into the liner in order to "scatter" the material over the inside of the liner as it comes through the filling tube, rather than simply allowing material to pile up immediately beneath the filling tube.

The machine used to make the filling tube assemblies could also be modified within the scope of the invention. For example, the jaws 21 would normally be automatically brought towards one another and kept in position for a predetermined length of time, after which they would automatically be withdrawn. There could however be provision for over riding the automatic control in order to cater for different thicknesses or types of plastics

material.

WHAT WE CLAIM IS:—

1. A method of making a filling tube for a container liner for bulk granular materials, the method comprising the steps of taking a sheet of flexible plastics material in which a filling aperture has been formed, stretching the aperture over a tubular mandrel of larger diameter than the aperture so as to form around the periphery of the aperture a lip which projects from the plane of the sheet, fitting over the mandrel and around said lip a flexible plastics tube, and heat welding the tube to the lip around their region of overlap.

2. A method according to claim 1, in which said sheet comprises, or forms part of, a wall of the liner.

3. A method according to claim 1, in which the sheet is initially separate from the wall of the liner, comprising the further step of heat welding or otherwise sealing the sheet onto a wall of the liner.

4. A method according to claim 3, comprising the further step of breaking the liner wall, within the periphery of the seal between the wall and the filling tube, in order that granular material fed through the filling tube can be admitted into the liner.

5. A method according to claim 4, in which the liner wall is broken by cutting a suitably sized hole in the wall within the periphery of said seal.

6. A method according to claim 4, in which the liner wall is broken by slitting or perforating the wall within the periphery of said seal, so that granular material fed through the filling tube can force its way into the liner.

7. A method of making a filling tube for a container liner, carried out substantially in accordance with any of the methods described herein.

8. A method according to claim 7, carried out substantially as described herein with particular reference to Figures 1 to 6; or to those Figures when modified as in Figures 7 to 9, of the accompanying drawings.

9. A filling tube, or a liner, when made by a method in accordance with any preceding claim.

10. A container liner for bulk granular material, the liner being made of a flexible plastics material and having one or more filling tubes, also of a flexible plastics material, projecting from its outer surface, the or each filling tube being heat welded around the lipped periphery of a tubular filling aperture formed in, or secured to, a wall of the liner.

11. A liner according to claim 9 or claim 10, the liner having the general form of an elongate tube of flexible plastics material closed at each end with one or more of said filling tubes at positions spaced along its length.

12. A machine for producing a filling tube for a container liner for bulk granular material, the machine comprising a table, a tubular mandrel projecting from the surface of the table, a pair of jaws moveable in and out of a position in which they closely surround the peripheral surface of the mandrel, and heating elements incorporated in the jaws, the arrangement being such that the heated jaws can be moved into their mandrel surrounding position, carry out a heat welding operation around the region of overlap of a flexible plastics tube and the lipped periphery of an aperture formed in a flexible plastics sheet and fitted over the mandrel, and can then be withdrawn from their mandrel surrounding position to enable the welded assembly to be removed from the mandrel.

13. A machine, for producing a filling tube for a container liner for bulk granular material, substantially as described herein, with reference to and as illustrated in Figures 1 to 3 of the accompanying drawings.

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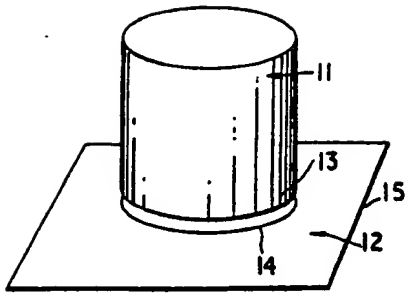
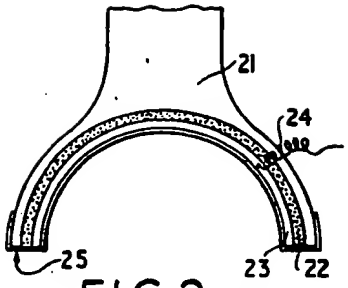
1511729 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

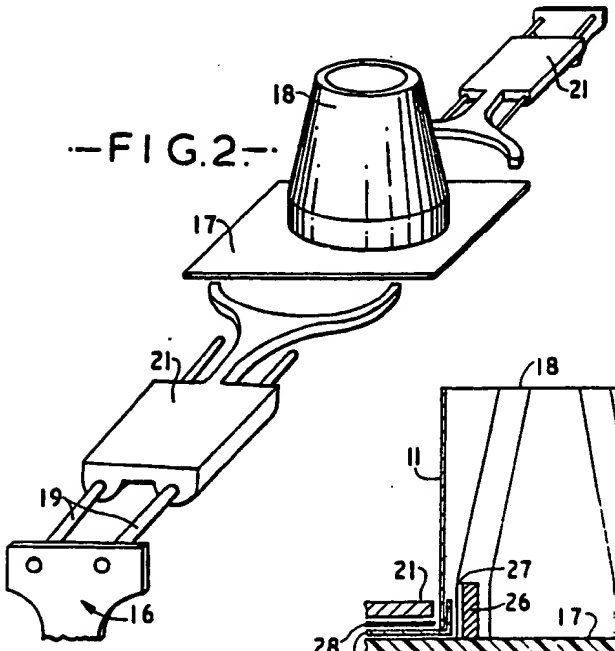


-FIG.1.-



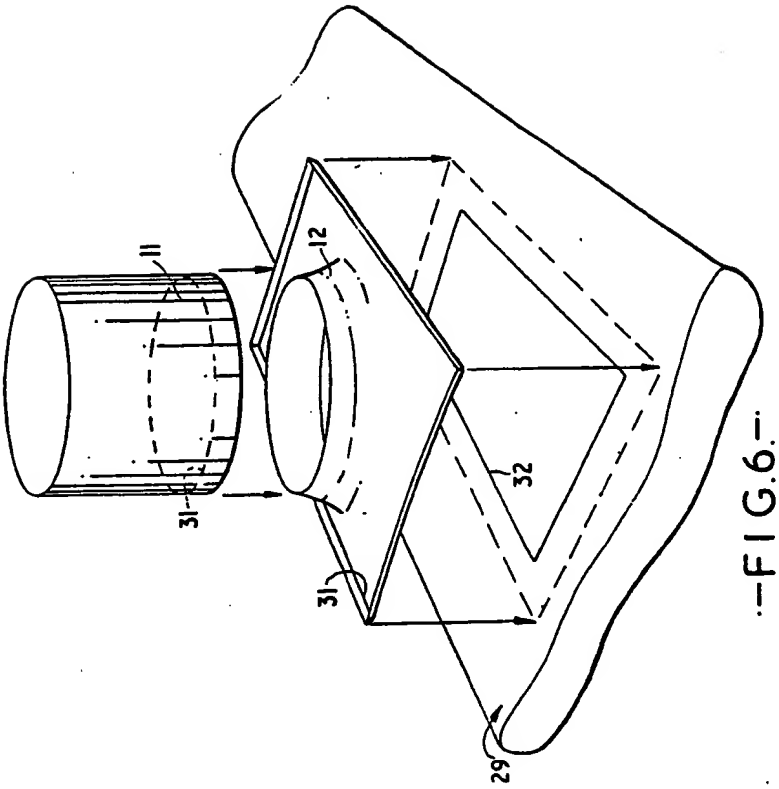
-FIG.2a.-

-FIG.2.-

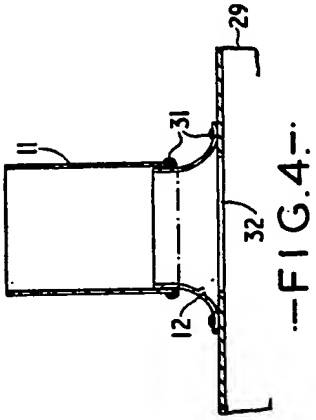


-FIG.3.-

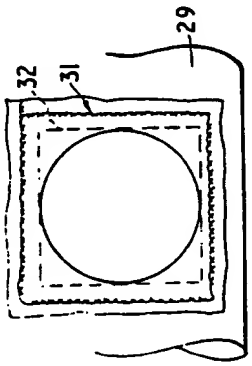
1511729 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2



-FIG.6.-



-FIG.4.-

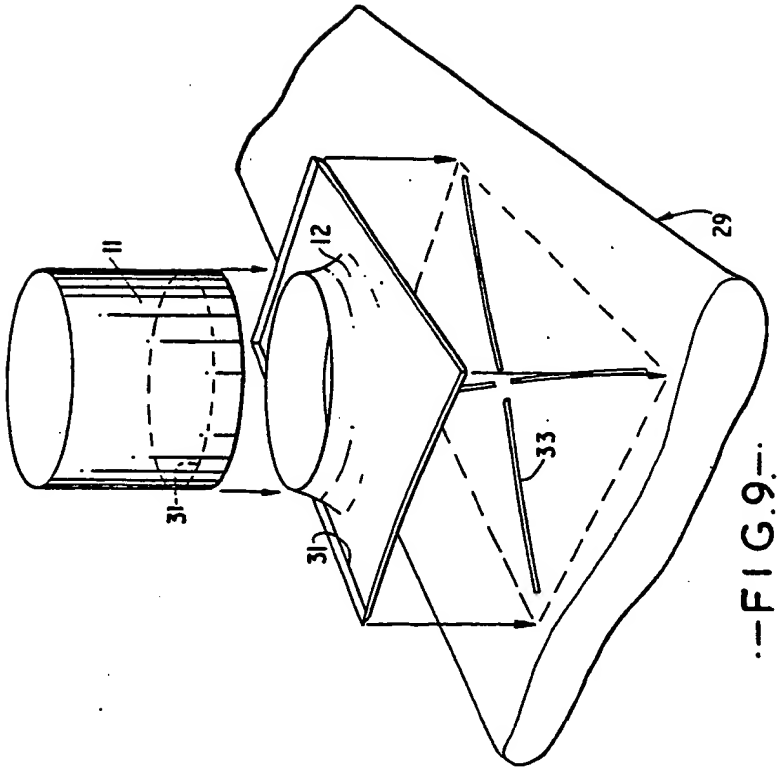


-FIG.5.-

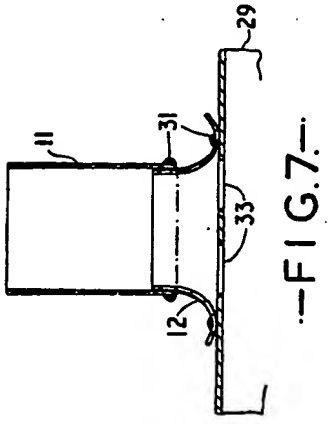
1511729 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

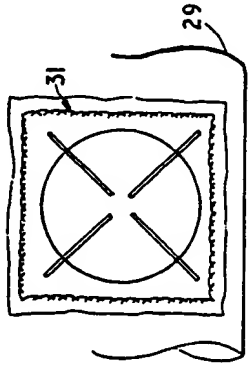
Sheet 3



—FIG.9.—



—FIG.7.—



—FIG.8.—